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High-flying engineer helps pick new ejection seat

Finds Ellington Field culture based on interdependency, teamwork

By Elizabeth Soutter

As the sun rose over Ellington Field the morning of the STS-85 launch, a seven-member team comprised of pressure suit technicians, ground crew mechanics, an electrician and a quality officer continued work they had begun the night before to prepare two people for a single flight to Florida.

The flight would pass over the Kennedy Space Center at 60,000 feet, flying through the plume of vapor left behind after *Discovery* thundered into space.

At this altitude, the air is too thin for ordinary engines and wings. Ellington's WB-57F high weather/reconnaissance aircraft, however, has a wingspan of 122 feet. A cramped cockpit is perched between the wings, which are powerful enough to lift the plane to 68,000 feet, at the top of the troposphere.

This altitude means special considerations must be made for human cargo.

"Once you're at an altitude of 50,000 feet, if you don't have pressurized oxygen going into your lungs, you'll experience rapid unconsciousness," says WB-57F Assistant Project Engineer Shelley Hilden. "But it's really an issue at 63,000 feet. That's right about the point where the barometric pressure is less than your tissue pressure. So at 63,000 feet if you were to lose cabin pressure, your tissues would vaporize and your blood would boil."

To prevent such an occurrence, occupants of the WB-57F wear pressure suits. "If the cabin depressurizes, the suit would inflate and keep the pressure around my body," Hilden says.

Similar in appearance to the ones astronauts wear during shuttle ascent and entry, the fluorescent orange suit must be worn throughout the six-hour mission.

"I told the pilot I was waiting for him to turn off the fasten seatbelt sign so I could move about the cabin," Hilden joked. "Obviously that's just not possible seeing as the cockpit is just a little bigger than I am. It's not very comfortable. But it doesn't bother me at all."

Hilden's addiction to high-tech aircraft began during her years as a co-op at JSC. An aerospace engineering major at the University of Minnesota, Hilden became interested in NASA in her Freshman year. She wrote to all

the NASA centers in the country, requesting information on co-op and internship programs. She was accepted to the JSC program in 1992.

Hilden first saw Ellington Field as part of an educational tour with the Co-op Tours and Lectures series. Ellington Pilot Jack "Triple" Nickel was showing students the T-38 jet aircraft trainer. Hilden was entranced by it.

While it was years before she flew a T-38, Hilden did arrange for her next tour to be at Ellington, working Shuttle Training Aircraft software. In 1994, she joined Ellington as a full-time engineer. Six months later, Hilden

became assistant project engineer for the WB-57F and found herself in an orange pressure suit at 65,000 feet monitoring data collection on the atmosphere.

"I was very excited to work on the WB-57F," Hilden says. "I finally had a great project I could sink my teeth into and learn a lot from and be inspired to work."

Since then, she has logged 75 hours in the high-altitude research aircraft. This new job has an added bonus for Hilden—she has logged 20 hours of air time in T-38s, the result of crew change-outs during long deployments for the WB-57F. She and one pilot will fly the T-38 to rendezvous with the WB-57F, and the other pilot and engineer will fly the jet back.

Hilden has found an entirely unique way of life at Ellington Field, based on interdependency and team work.

"In any kind of spacecraft or aircraft work you are dependent not only upon the hardware, the software, the technology that goes into building your vehicle, but also on the people. There has to be a very large emphasis on safety. There has to be. What we are doing is inherently dangerous."

When Hilden flies aboard the WB-57F, she

is aware that her safety is in the hands of the pilot flying the plane and the engineers and mechanics supporting her flight.

"My life is dependent upon the suit technicians. If they give me a faulty suit and we lose pressure at 60,000 feet, I'm a pink mist in the cockpit," Ellington pilots, she adds, "are calm and collected and have no doubts in the aircraft. It's very reassuring."

Hilden has herself recently taken the burden for the safety of others. She and logistician and maintenance officer Jose Rangel have been charged with finding a new T-38 ejection seat.

Hilden and Rangel have been working together on this project for nearly six months. They began by researching the function of an ejection seat. A presentation by an Air Force official illustrated to Hilden the importance of her assignment.

"He gave us a presentation on new ejection seat technology and what we should be looking for in a new seat. The last slide was a picture of a pilot and the pilot's spouse. And I thought: 'This is why we are doing this. We are doing this to save lives. We're doing this so that if this pilot has to eject, this pilot will have the greatest chance of surviving.' We want the pilot to be able to pull the handle and go and not have to think about it. We're doing the work now so they don't have to later."

Ejection is not a gentle process. The two cockpit canopies and the aft and forward seats are blown clear of the aircraft. A spring loaded drogue chute on each seat keeps it from spinning as its occupant is released from the seat harness and the barometric parachute deployment system is armed. At or below 14,000 feet, a charge deploys the parachute that almost instantly slows the user's fall from 200 to 10 feet per second. All told, five explosions

and two violent decelerations accompany the use of this particular safety feature.

Hilden and Rangel have brought in five companies from the United States, the United Kingdom and Russia to demonstrate the newest innovations in ejection seat technology.

The current seat, installed by the airplane's manufacturer, Northrop Grumman was designed in 1959. Hilden's assignment is to look at the anthropometrics of the new seat—that is, its compatibility with a wide range of body types.

"It's not just a question of women," Hilden says, "but of all smaller crew members. A seat that doesn't account for a lot of different body shapes is going to hurt people."

Finding a seat that allows for people of different height and weight has some complex factors involved. The user must be fairly comfortable, and able to reach all the controls inside the aircraft. In addition, the rocket and the man-seat separator system must be able to accommodate the different centers of gravity that come with differing body size.

Hilden and Rangel are looking for a seat that will be dependable at zero altitude and zero speed. A so called "zero-zero" seat would enable crew members to evacuate an aircraft that was still on the runway. They must also consider the timing involved in safe ejection.

"In the current system," Hilden says, "the pilot in the front seat has to say to the passenger in back, 'You go on two, I go on three, one-two-three.'"

If there is a miscommunication or error and the person in front ejects first, the gases from the ejection seat may burn the passenger in the rear cockpit. There also is potential for a mid-air collision. Many of the seats the team is looking at prohibit the forward passenger from ejecting first and eliminate the need for passengers to wear individual parachutes.

The current system, with the pilot and passenger wearing their parachutes on their backs, is not only uncomfortable, it is not as dependable as a chute packed in the ejection seat head box.

Hilden's commitment and enthusiasm are evident when she speaks of her experience at Ellington Field. "It all comes down to people," she said. "In the end, working out here is about keeping people safe and keeping them flying."



‘In any kind of spacecraft or aircraft work you are dependent not only upon the hardware, the software, the technology that goes into building your vehicle, but also on the people.’

—Shelley Hilden
WB-57F Assistant Project Engineer



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Top left: NASA Flight Engineer John Lamb, left, and co-workers Chris Sanzibal, of DynCorp, and Scott Reagan, of NASA, go through a pre-flight checklist prior to a WB-57F high-altitude flight to collect air samples at Kennedy Space Center following a space shuttle launch and test the effects of solid rocket plume gases on the environment. Top center: WB-57F Pilot Rich Hull, left, and systems engineering officer Shelley Hilden, also WB-57F assistant project engineer, get suited up for their flight as DynCorp suit technician Sanzibal performs pressure checks on the suits. Top right: From left, DynCorp's James Lee, and Bill Harrison, Brian Miller, and Peter Winwright, all of seat manufacturer Martin-Baker, lift the prototype ejection seat from the T-38 aircraft in Ellington Field's Hangar 135. Left: The cockpit of the WB-57F is ready to be closed prior to flight as, from left, DynCorp electrician Walt Townley, and mechanics Louis Valle and Luther Levan, and NASA Quality Assurance and Mission Manager Bud Meins make a final inspection of the aircraft just before takeoff.

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